CLAY MASONRY FAMILY FALLOUT SHELTERS

MP-18
February 1960

Reprinted by:
OFFICE OF CIVIL AND DEFENSE MOBILIZATION

CONTENTS

	Page
Introduction	3
Basement Shelter, Existing Construction	4
Basement Shelter, New Construction	5
Underground Shelter	6
Aboveground Shelter	6
Blast and Fallout Shelter, Aboveground	6
Appendix	8

DEFINITIONS

Radioactive fallout is particles of earth and debris drawn up into the fireball and resulting mushroom shaped cloud of a nuclear explosion which become radioactively contaminated, and later fall back to earth.

Radioactivity is the emission of radiant energy, alpha, beta, and gamma rays, by the disintegration of the nuclei of atoms.

Shielding—There are two methods of shielding from fallout radiation: *barrier shielding* and *geometry shielding.*

Barrier shielding is the placing of a mass between the fallout field and the individual. The heavier the protective barrier, the greater the barrier shielding effect.[1]

Geometry shielding is determined by the extent of the fallout field affecting an individual, and/or his distance from it.[2]

Mass thickness is the weight per unit surface area of a barrier, usually expressed in pounds per square foot. See Table II, which indicates commercially available wall thicknesses for equivalent mass thicknesses of several materials.

Protection factor—The combined effects of barrier shielding and geometry shielding result in a shelter "protection factor". This term is used by technicians to express the relative reduction in the amount of radiation that would be received by a person in a protected location, compared to the amount he would receive if he were unprotected. For example if a shelter has a protection factor of 500, an unprotected person would be exposed to 500 times more radiation than someone inside the shelter.

Wythe—Each continuous vertical 4 inches or greater section of thickness of masonry.

Overpressure—For nuclear blast design, the first important decision that must be made is the level of blast pressure that is to be resisted by the structure. This pressure is spoken of as "overpressure", or the excess of pressure over normal atmospheric pressure due to the passage of the shock front.

Reflected pressure—When the blast wave strikes a surface, such as that of a structure, a reflected pressure results which can be more than twice the value of the peak overpressure.

---

[1] "Fallout Shelter Surveys: Guide for Executives," Office of Civil and Defense Mobilization, October 1959.

[2] Ibid.

INTRODUCTION

Radioactive fallout respects no person and no place. There is not a home in America that could not be affected by fallout after a nuclear attack. Shelter from fallout is the greatest single protection for you and your family.

The Office of Civil and Defense Mobilization published last year "The Family Fallout Shelter" booklet MP 15. That publication contains plans for five basic fallout shelters.

The Structural Clay Products Institute of Washington, D. C., has prepared the booklet "Clay Masonry Family Fallout Shelters" in order to provide the public with five additional plans for basic fallout shelters which can be built in or near your home. OCDM technical officers have reviewed and found that it meets OCDM standards for effective shelter.

Each of these shelters provides protection from fallout radiation of a nuclear bomb. They also can protect your family against natural disasters such as hurricanes and tornadoes.

This booklet demonstrates again that there ***are*** means of protection against fallout—if you do something about it before disaster strikes.

LEO A. HOEGH
Director
Office of Civil and Defense Mobilization

BASEMENT SHELTER, EXISTING CONSTRUCTION

You can provide your family with substantial protection against fallout radiation with a minimum of difficulty and at reasonable cost with a clay masonry basement type fallout shelter. Basement shelters generally are the least expensive type that will provide substantial protection. The basement shelter (shown in various stages of construction in figs. 1, 2, 3, 4) can be built at a cost of about $300 by a "do-it-yourselfer" with the help of a neighbor in about 2 week-ends. However, it is recommended that a regular building contractor be employed for the job. The approximate building time for a contractor is 32 man-hours.

The design of the shelter makes it useful also as a hobby shop, darkroom, snack bar, or storage room. Besides fallout protection, the shelter provides refuge from natural disasters such as tornadoes and hurricanes. However, it is important to remember that the primary purpose of this shelter is to protect your family against the deadly effects of radioactive fallout.

If the shelter is to serve a dual purpose which requires a serving window, it will be necessary to install a lintel over the opening. Enough loose wall units must be available near the serving window to fill it in an emergency.

Shelves may be constructed along the stud wall using 1″ x 8″ boards. In general, the shelter should be located in the basement corner where the floor is farthest below the level of the outside ground.

It is best to avoid areas having outside windows. If it is necessary to build in this area, any windows in the basement walls must be filled with solid units or filled hollow units of the same thickness as the basement wall itself. If a window is located in a window well completely below grade, it may only be necessary to cover the window well with boards when an emergency arises and pile filled sand bags on top of them.

All types of fallout shelters have general requirements. They include (1) amount of fallout protection or shielding, (2) arrangement of the entrance, (3) ventilation, (4) radio reception, (5) lighting, (6) housekeeping problems, (7) sanitation, (8) food, (9) medical supplies, (10) utensils, and (11) the size of the shelter itself.

Each shelter should be designed to accommodate the occupants of the household. The Office of Civil and Defense Mobilization (OCDM) recommends that family shelters provide a minimum of 10 square feet of floor area and 65 cubic feet of volume per person.

The entrance into the shelter should have at least one right-angle turn to reduce radiation intensity inside the shelter.

Ventilation is provided in this type of basement fallout shelter by vents in the wall and by the open entrance. A blower may be installed to increase comfort.

As soon as the shelter is built, a check for radio reception must be made. Radio reception is cut down by the shielding necessary to keep out radiation. It probably will be necessary to install an outside antenna to receive CONELRAD broadcasts.

During occupancy, OCDM recommends provision for continuous low-level lighting in the shelter by means of a 4-cell hot-shot battery to which is wired a 150 milliampere flashlight-type bulb. This device will furnish light continuously for about 10 days. A flashlight or electric lantern should be available for those periods when brighter light is necessary. Where the shelter is to have a dual-purpose peacetime use, it is desirable to have an electric light fixture installed. This source of light and power may be available during a fallout emergency since, in many areas, commercial electric service may be maintained.

This basement-type Family Fallout Shelter may be built in a newly constructed house as well as in an existing house if the owner so desires. Construction of this basement shelter requires the knowledge of what tools and materials are necessary. One must also know

the quantity of materials needed to complete the structure. Table V furnishes a list of tools required for the construction of the "Basement-Type Clay Masonry Family Fallout Shelter." Table VI furnishes a list of materials required.

One method of building this shelter is outlined by the following steps:

1. Trace the outline (guide lines) of the shelter walls on the basement floor.
2. Lay a course of 8″ x 8″ x 12″ clay tile, conforming to ASTM Specifications C34, Grade LB in ½-inch mortar joints, along the guide lines on the basement floor. The mortar shall contain 1 part cement, 1 part lime or lime putty, and 6 parts sand. It shall be mixed with a hoe in a mixing pan for a period of 3 minutes with the amount of water required to produce the desired workability.
3. Fill the tile cells with pit-run sand.
4. Provide ventilation holes in the second course by turning 2 tile units on their side as indicated in figure 2.
5. Repeat steps No. 2 and 3 until desired wall height is attained. Notch out tile in top course to take 2″ x 6″ joists. Three courses of brick may be used in lieu of final course of tile. (See detail on line drawing, fig. 5.)
6. Place 2″ x 4″ plate on the floor along the wall to receive 2″ x 4″ studs. Attach plate to wall with ½″ bolts, 2′ - 0″ on center, and 4 inches from each end of plate.
7. Attach studs with ½″ bolts to existing basement wall at the center and 1 foot from each end of the studs. Nail 2″ x 4″ joist support to studs.
8. Place 2″ x 6″ joists into position and toe-nail them to 2″ x 4″ studs and support. Brace them in position with 2″ x 4″ blocking.
9. Allow walls to cure 24 hours prior to installation of shelter roof.
10. Nail 1″ x 8″ board across joists and alternately stack on 4 courses of brick to make up the roof. Stagger the brick so that vertical joints are not above one another.
11. Repeat step No. 10 until roof is complete.

Brick is an excellent material that can be used for the construction of fallout shelters. If brick is used for the construction of the basement shelter, step number 3 is eliminated. Figure 4 shows a basement shelter built of brick.

BASEMENT SHELTER, NEW CONSTRUCTION

New construction furnishes the home owner with an opportunity to erect a fallout shelter immediately adjacent to his basement. It will provide excellent protection against fallout radiation. This shelter is built as an extra room in the basement and would add approximately $500 to $700 to the total cost of the house. Figure 6 is the line drawing for the Basement Shelter, New Construction.

On the basis of current Office of Civil and Defense Mobilization criteria, this shelter has a protection factor of 1,000 or more.

This shelter can have multiple uses. It can serve as a refuge from natural disasters such as tornadoes and hurricanes.

This shelter can be made blast resistant by providing a blast-resistant, heat-reflective door at the entrance. This shelter design already has some inherent blast resistance (approximately 5-7 psi blast overpressure). It may be necessary, however, to provide increased wall strength depending upon the desired design overpressure. A competent engineer should be employed to design this shelter to provide the additional stability.

UNDERGROUND SHELTER

An underground clay masonry fallout shelter can be built by a contractor for about $800 to $1,200, depending upon the entrance used. Figure 7 is the line drawing for this shelter. The shelter will provide excellent fallout protection. It has a protection factor of 1,000 or more on the basis of OCDM criteria.

The line drawing (fig. 7) shows the shelter with earth mounded over the roof. This shelter can be built into an embankment or entirely below grade.

This shelter also provides excellent protection against hurricanes and tornadoes, and can easily be made blast resistant by providing a blast-resistant door at the entrance. It already has some inherent blast resistance (approximately 5 - 7 psi blast overpressure). It may be necessary, however, to provide greater stability depending upon the design overpressure. If a blast shelter is desired, it is recommended that a competent engineer be employed.

ABOVEGROUND SHELTER

An outdoor aboveground fallout shelter can be built of clay masonry units. Most generally this type of shelter is built in regions where water or rock is close to the earth's surface making it impractical to build underground.

The exterior walls of this shelter are constructed of two wythes of brick, 1-foot, 8-inches apart. The space between the brick is filled with compacted pit-run sand or gravel. The two brick wythes are tied together with non-corrosive metal ties as indicated on the line drawing shown as figure 8.

The roof is a 6-inch reinforced concrete slab, having a brick parapet wall. Upon this slab is placed two coats of hot asphalt waterproofing, then 16 to 20 inches of pit-run sand or gravel fill.

This shelter will provide exceptionally good protection against fallout at a cost of about $900 to $1,250. This shelter has a protection factor of 250 to 1,000, based on OCDM criteria.

BLAST AND FALLOUT SHELTER ABOVEGROUND

Reinforced Brick Masonry (RBM) is employed in making the family shelter shown as figure 9 resistant to blast as well as fallout. This aboveground shelter provides excellent protection against the ravages of hurricanes and tornadoes in addition to its radiation shielding. Most generally this type of shelter is built in regions where water or rock is close to the earth's surface, making it impractical to build underground.

A family in this shelter would be protected from a nuclear explosion of 20-megaton size as close as 5 miles from ground zero. The radiation protection factor of this shelter is approximately 600 - 700, based on OCDM criteria.

The exterior walls of the shelter are constructed of two walls of brick masonry, 1 foot apart. One wall is a 10-inch RBM wall and the other is 4 inches of brick tied to the RBM wall with non-corrosive metal ties spaced as indicated on the drawing (fig. 9). The space between the brick is filled with compacted pit-run sand or gravel.

The roof is a 10-inch slab of reinforced concrete upon which is poured 10 more inches of fill concrete, making a total roof thickness of 20 inches. The door is blast resistant and heat reflective, able to withstand a blast overpressure of approximately 10 pounds per square inch.

Blast and fallout protection is provided by this shelter at a cost of approximately $1,200 to $1,700 dollars.

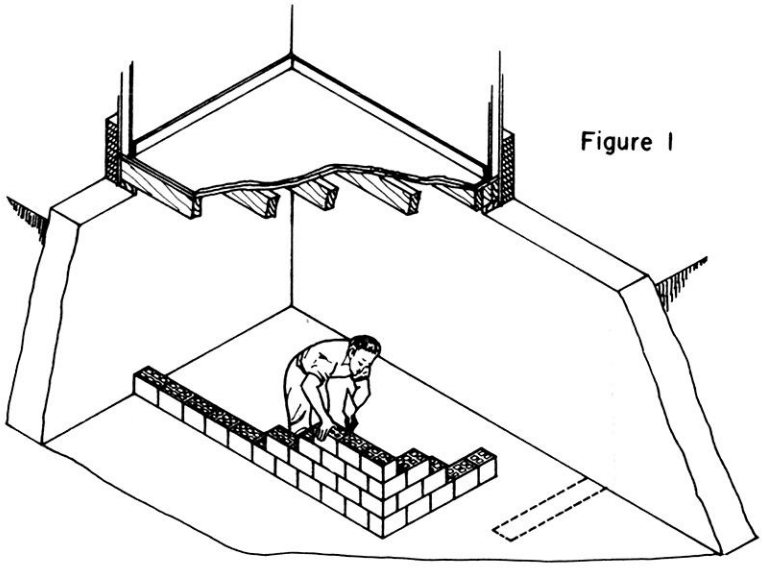


Figure 1

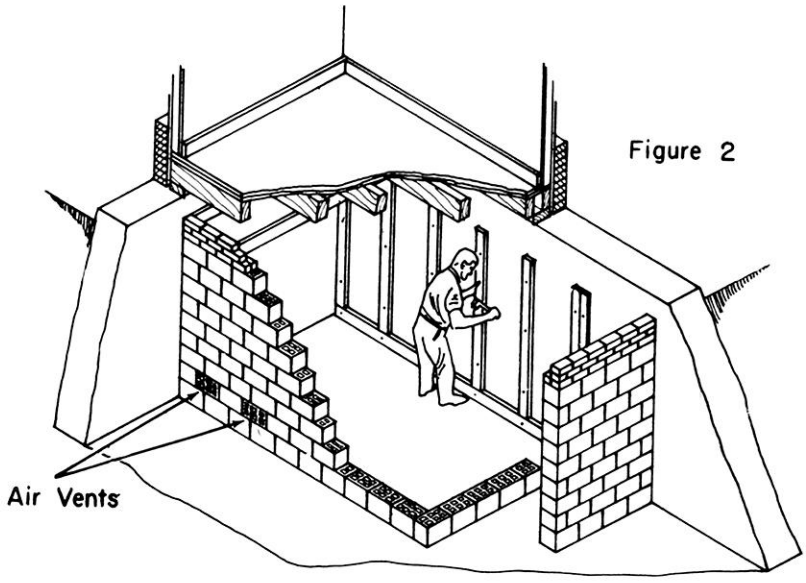


Figure 2

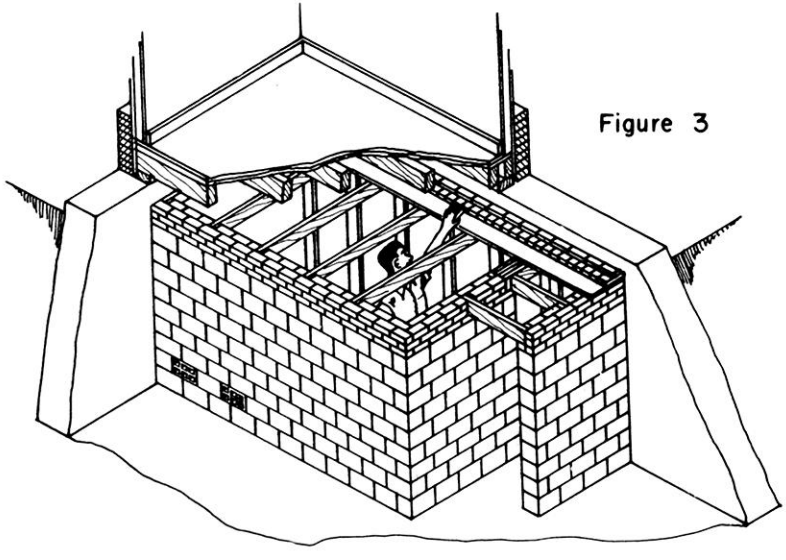


Figure 3

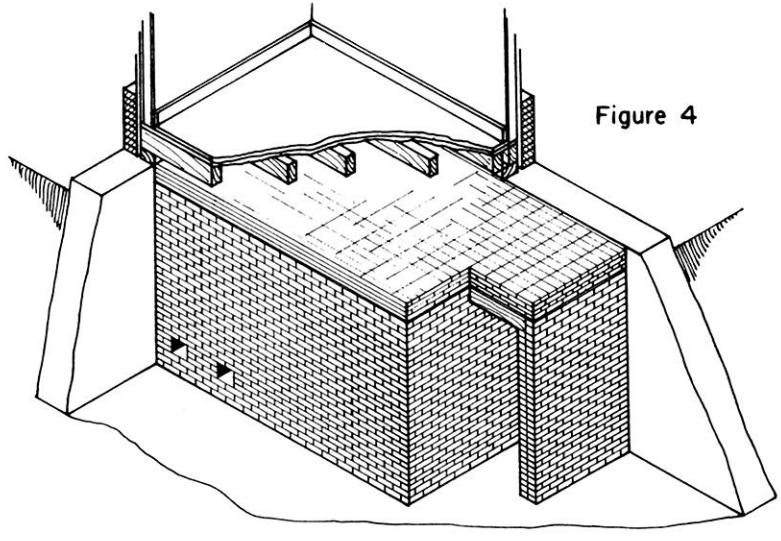


Figure 4

APPENDIX

CONTENTS

Page

Fig. 5—Basement Shelter, Existing Construction ---------- 9

Fig. 6—Basement Shelter, New Construction ---------- 10

Fig. 7—Underground Shelter ---------- 11

Fig. 8—Aboveground Shelter ---------- 12

Fig. 9—Blast and Fallout Shelter, Aboveground ---------- 13

Table I—Radiation protection factors ---------- 14

Table II—Equivalent mass thicknesses ---------- 14

Table III—Relation of overpressure to distances from ground zero 15

Table IV—Description of shelter protection categories ---------- 15

Table V—Tools required for building Basement Shelter, Existing Construction ---------- 16

Table VI—Materials required for building Basement Shelter, Existing Construction ---------- 16

Note: Larger scale drawings of figures 5, 6, 7, 8, and 9 may be obtained through your local civil defense organization, or from OCDM, Battle Creek, Michigan. It is important that drawings be ordered by "Figure Number" and that reference be made to this publication, MP–18.

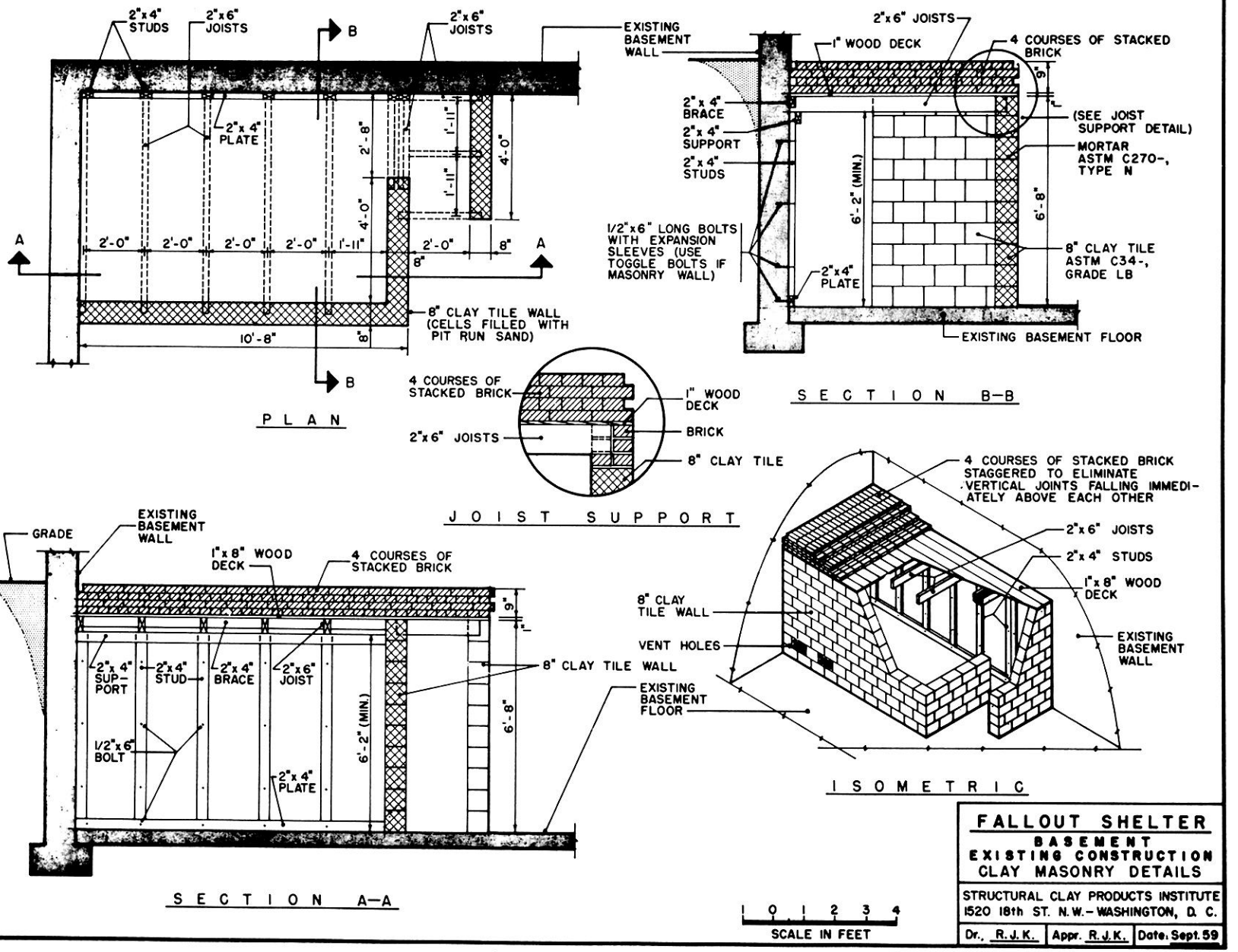

2"x4" STUDS
2"x6" JOISTS
B
2"x6" JOISTS
EXISTING BASEMENT WALL
2"x4" PLATE
2'-8"
1'-11"
1'-11"
4'-0"
4'-0"
A
2'-0"
2'-0"
2'-0"
2'-0"
1'-11"
2'-0"
8"
8"
A
8" CLAY TILE WALL (CELLS FILLED WITH PIT RUN SAND)
10'-8"
8"
B
PLAN
2"x6" JOISTS
1" WOOD DECK
4 COURSES OF STACKED BRICK
9"
1"
(SEE JOIST SUPPORT DETAIL)
2"x4" BRACE
2"x4" SUPPORT
2"x4" STUDS
MORTAR ASTM C270-, TYPE N
6'-2" (MIN.)
6'-8"
1/2"x6" LONG BOLTS WITH EXPANSION SLEEVES (USE TOGGLE BOLTS IF MASONRY WALL)
8" CLAY TILE ASTM C34-, GRADE LB
2"x4" PLATE
EXISTING BASEMENT FLOOR
SECTION B-B
4 COURSES OF STACKED BRICK
1" WOOD DECK
2"x6" JOISTS
BRICK
8" CLAY TILE
JOIST SUPPORT
4 COURSES OF STACKED BRICK STAGGERED TO ELIMINATE VERTICAL JOINTS FALLING IMMEDIATELY ABOVE EACH OTHER
2"x6" JOISTS
2"x4" STUDS
1"x8" WOOD DECK
8" CLAY TILE WALL
VENT HOLES
EXISTING BASEMENT WALL
8" CLAY TILE WALL
EXISTING BASEMENT FLOOR
ISOMETRIC
GRADE
EXISTING BASEMENT WALL
1"x8" WOOD DECK
4 COURSES OF STACKED BRICK
9"
1"
2"x4" SUP-PORT
2"x4" STUD
2"x4" BRACE
2"x6" JOIST
8" CLAY TILE WALL
1/2"x6" BOLT
2"x4" PLATE
6'-2" (MIN.)
6'-8"
SECTION A-A
0 1 2 3 4
SCALE IN FEET
FALLOUT SHELTER
BASEMENT
EXISTING CONSTRUCTION
CLAY MASONRY DETAILS
STRUCTURAL CLAY PRODUCTS INSTITUTE
1520 18th ST. N.W. - WASHINGTON, D. C.
Dr., R.J.K.
Appr. R.J.K.
Date, Sept. 59

Figure 5

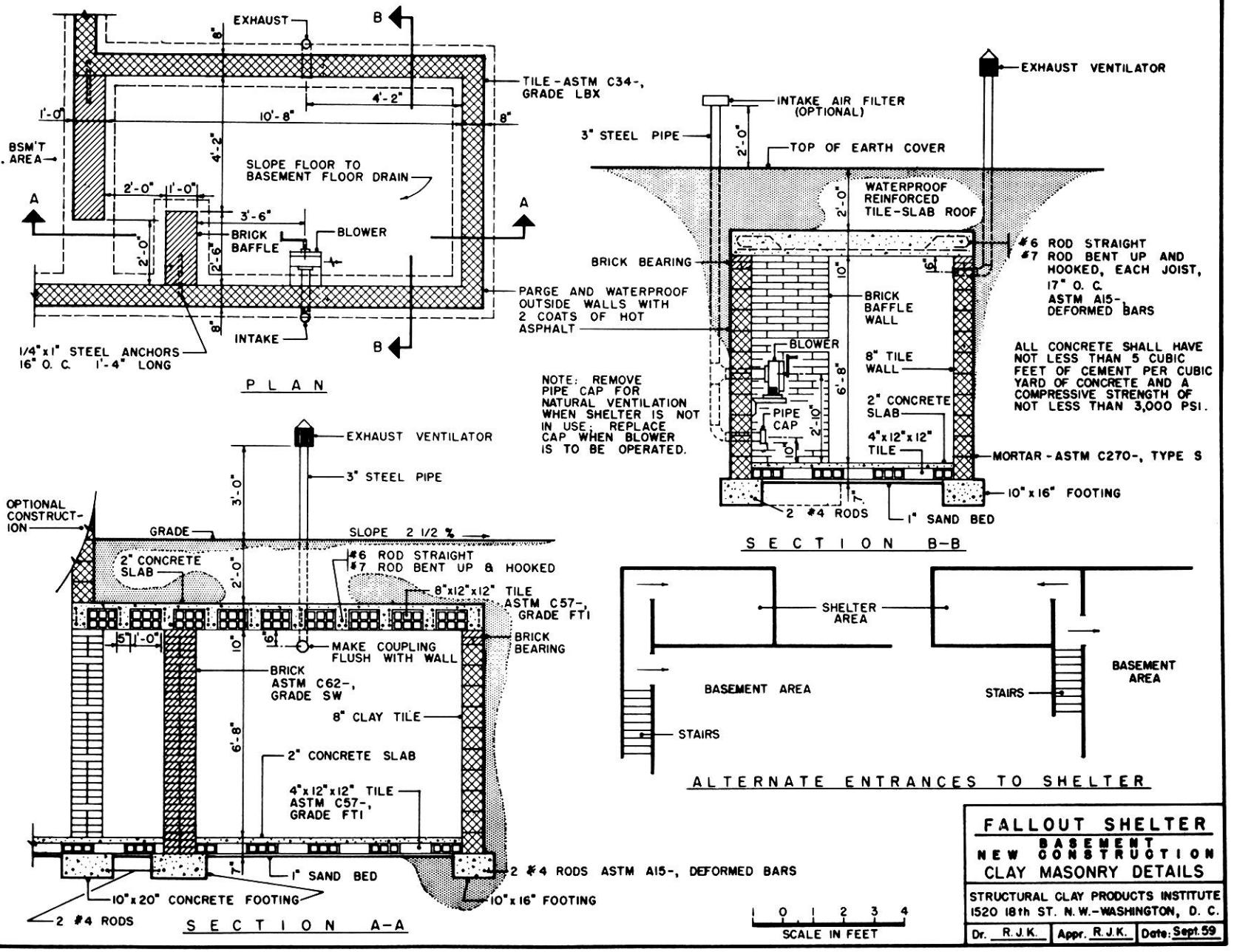

EXHAUST
B
TILE - ASTM C34-, GRADE LBX
4'-2"
10'-8"
8"
1'-0"
BSM'T. AREA
4'-2"
SLOPE FLOOR TO BASEMENT FLOOR DRAIN
A
2'-0"
1'-0"
3'-6"
BRICK BAFFLE
BLOWER
2'-0"
2'-6"
PARGE AND WATERPROOF OUTSIDE WALLS WITH 2 COATS OF HOT ASPHALT
8"
INTAKE
1/4"x1" STEEL ANCHORS 16" O. C. 1'-4" LONG
PLAN
EXHAUST VENTILATOR
INTAKE AIR FILTER (OPTIONAL)
3" STEEL PIPE
2'-0"
TOP OF EARTH COVER
2'-0"
WATERPROOF REINFORCED TILE-SLAB ROOF
#6 ROD STRAIGHT
#7 ROD BENT UP AND HOOKED, EACH JOIST, 17" O. C.
ASTM A15-, DEFORMED BARS
BRICK BEARING
10"
6"
BRICK BAFFLE WALL
BLOWER
8" TILE WALL
6'-8"
2" CONCRETE SLAB
PIPE CAP
2'-10"
4"x12"x12" TILE
MORTAR - ASTM C270-, TYPE S
10"x16" FOOTING
2 #4 RODS
1" SAND BED
NOTE: REMOVE PIPE CAP FOR NATURAL VENTILATION WHEN SHELTER IS NOT IN USE; REPLACE CAP WHEN BLOWER IS TO BE OPERATED.
ALL CONCRETE SHALL HAVE NOT LESS THAN 5 CUBIC FEET OF CEMENT PER CUBIC YARD OF CONCRETE AND A COMPRESSIVE STRENGTH OF NOT LESS THAN 3,000 PSI.
SECTION B-B
EXHAUST VENTILATOR
3" STEEL PIPE
3'-0"
OPTIONAL CONSTRUCTION
GRADE
SLOPE 2 1/2 %
2" CONCRETE SLAB
2'-0"
#6 ROD STRAIGHT
#7 ROD BENT UP & HOOKED
8"x12"x12" TILE ASTM C57-, GRADE FTI
5'-1'-0"
10"
6"
MAKE COUPLING FLUSH WITH WALL
BRICK BEARING
BRICK ASTM C62-, GRADE SW
8" CLAY TILE
6'-8"
2" CONCRETE SLAB
4"x12"x12" TILE ASTM C57-, GRADE FTI
7"
1" SAND BED
2 #4 RODS ASTM A15-, DEFORMED BARS
10"x20" CONCRETE FOOTING
10"x16" FOOTING
2 #4 RODS
SECTION A-A
SHELTER AREA
BASEMENT AREA
STAIRS
BASEMENT AREA
STAIRS
ALTERNATE ENTRANCES TO SHELTER
0 1 2 3 4
SCALE IN FEET
FALLOUT SHELTER
BASEMENT
NEW CONSTRUCTION
CLAY MASONRY DETAILS
STRUCTURAL CLAY PRODUCTS INSTITUTE
1520 18th ST. N.W.-WASHINGTON, D. C.
Dr. R.J.K.
Appr. R.J.K.
Date: Sept. 59

Figure 6

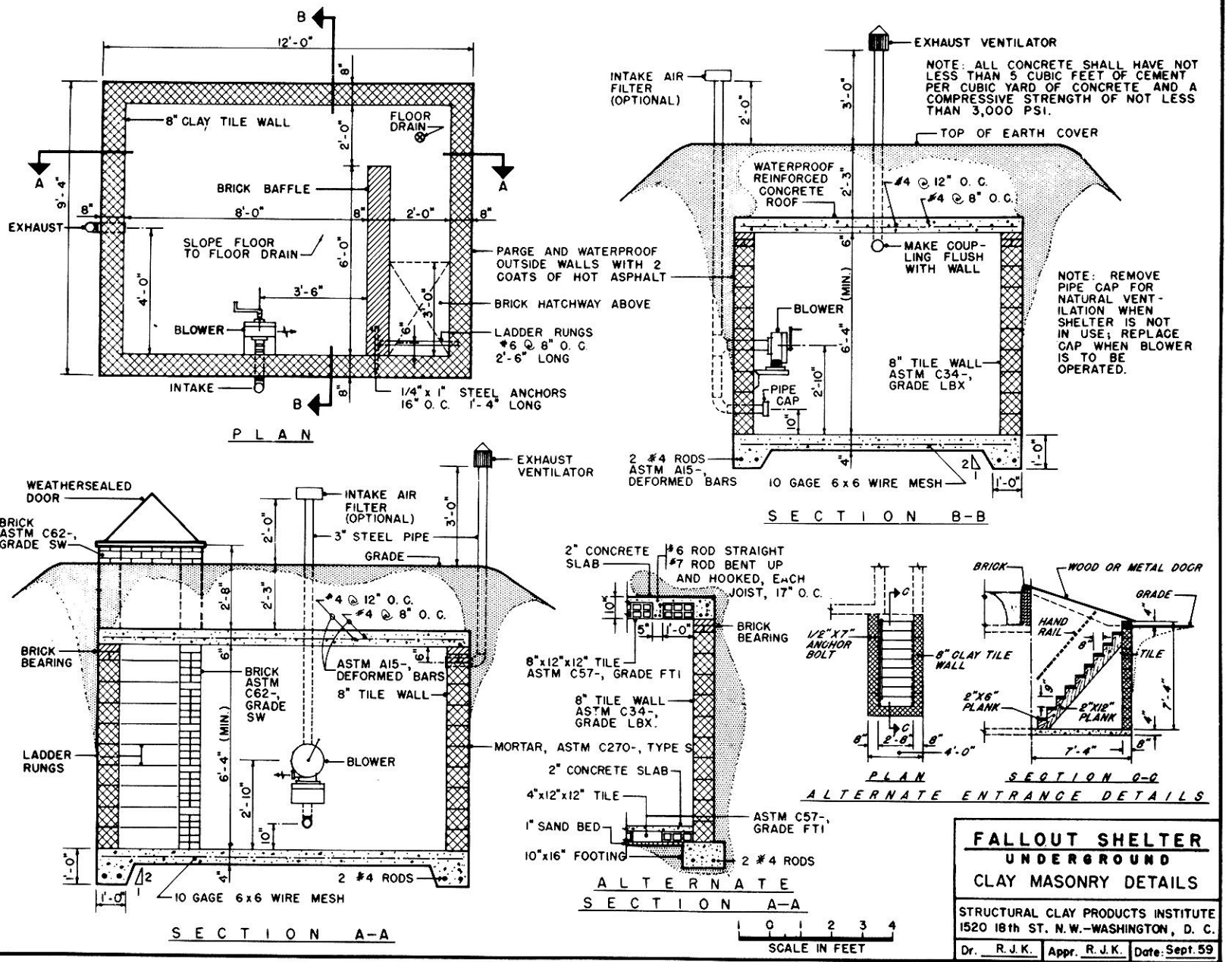
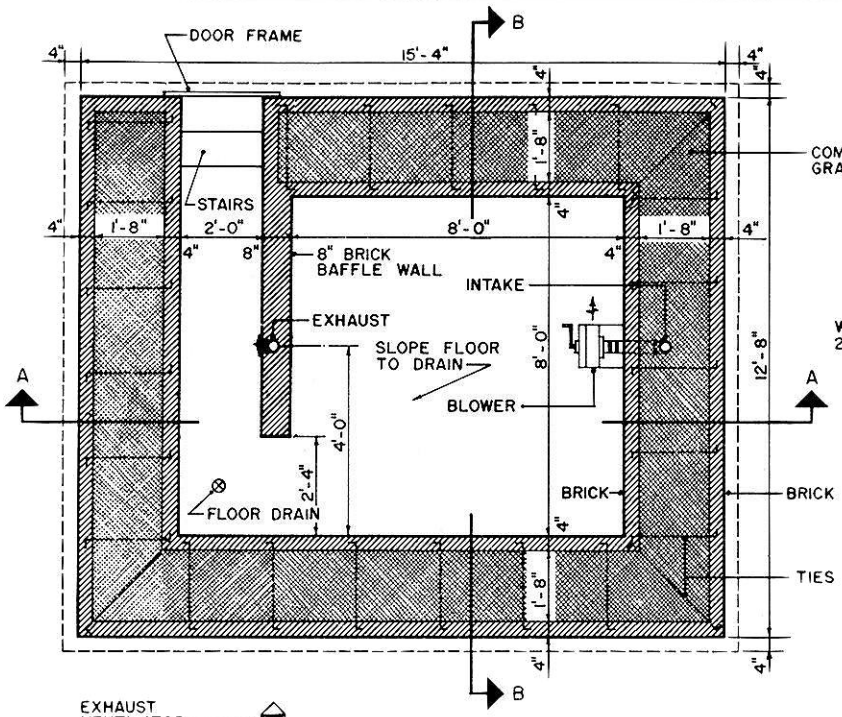
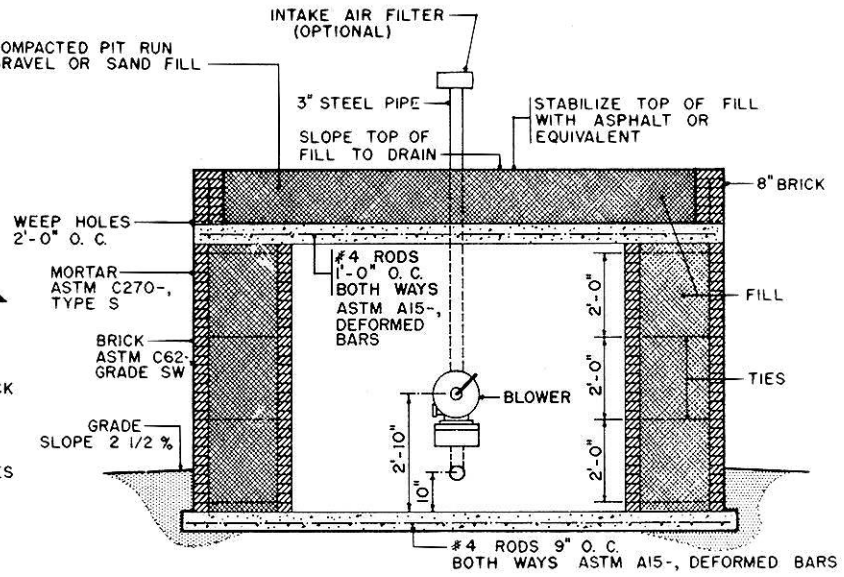

PLAN
8" CLAY TILE WALL
FLOOR DRAIN
BRICK BAFFLE
EXHAUST
SLOPE FLOOR TO FLOOR DRAIN
BLOWER
INTAKE
PARGE AND WATERPROOF OUTSIDE WALLS WITH 2 COATS OF HOT ASPHALT
BRICK HATCHWAY ABOVE
LADDER RUNGS #6 @ 8" O.C. 2'-6" LONG
1/4" x 1" STEEL ANCHORS 16" O.C. 1'-4" LONG
12'-0"
9'-4"
8'-0"
2'-0"
6'-0"
4'-0"
3'-6"
3'-0"
EXHAUST VENTILATOR
INTAKE AIR FILTER (OPTIONAL)
NOTE: ALL CONCRETE SHALL HAVE NOT LESS THAN 5 CUBIC FEET OF CEMENT PER CUBIC YARD OF CONCRETE AND A COMPRESSIVE STRENGTH OF NOT LESS THAN 3,000 PSI.
TOP OF EARTH COVER
WATERPROOF REINFORCED CONCRETE ROOF
#4 @ 12" O.C.
#4 @ 8" O.C.
MAKE COUPLING FLUSH WITH WALL
NOTE: REMOVE PIPE CAP FOR NATURAL VENTILATION WHEN SHELTER IS NOT IN USE; REPLACE CAP WHEN BLOWER IS TO BE OPERATED.
BLOWER
8" TILE WALL ASTM C34-, GRADE LBX
PIPE CAP
2 #4 RODS ASTM A15-, DEFORMED BARS
10 GAGE 6x6 WIRE MESH
SECTION B-B
EXHAUST VENTILATOR
WEATHERSEALED DOOR
BRICK ASTM C62-, GRADE SW
INTAKE AIR FILTER (OPTIONAL)
3" STEEL PIPE
GRADE
#4 @ 12" O.C.
#4 @ 8" O.C.
BRICK BEARING
ASTM A15-, DEFORMED BARS
8" TILE WALL
BRICK ASTM C62-, GRADE SW
LADDER RUNGS
BLOWER
MORTAR, ASTM C270-, TYPE S
2 #4 RODS
10 GAGE 6x6 WIRE MESH
SECTION A-A
2" CONCRETE SLAB
#6 ROD STRAIGHT
#7 ROD BENT UP AND HOOKED, EACH JOIST, 17" O.C.
BRICK BEARING
8"x12"x12" TILE ASTM C57-, GRADE FTI
8" TILE WALL ASTM C34-, GRADE LBX.
MORTAR, ASTM C270-, TYPE S
2" CONCRETE SLAB
4"x12"x12" TILE
1" SAND BED
ASTM C57-, GRADE FTI
10"x16" FOOTING
2 #4 RODS
ALTERNATE SECTION A-A
1/2"X7" ANCHOR BOLT
8" CLAY TILE WALL
2'-8"
4'-0"
PLAN
BRICK
WOOD OR METAL DOOR
GRADE
HAND RAIL
TILE
2"X6" PLANK
2"X12" PLANK
7'-4"
SECTION Q-Q
ALTERNATE ENTRANCE DETAILS
0 1 2 3 4
SCALE IN FEET
FALLOUT SHELTER
UNDERGROUND
CLAY MASONRY DETAILS
STRUCTURAL CLAY PRODUCTS INSTITUTE
1520 18th ST. N.W.-WASHINGTON, D. C.
Dr. R.J.K.
Appr. R.J.K.
Date: Sept. 59

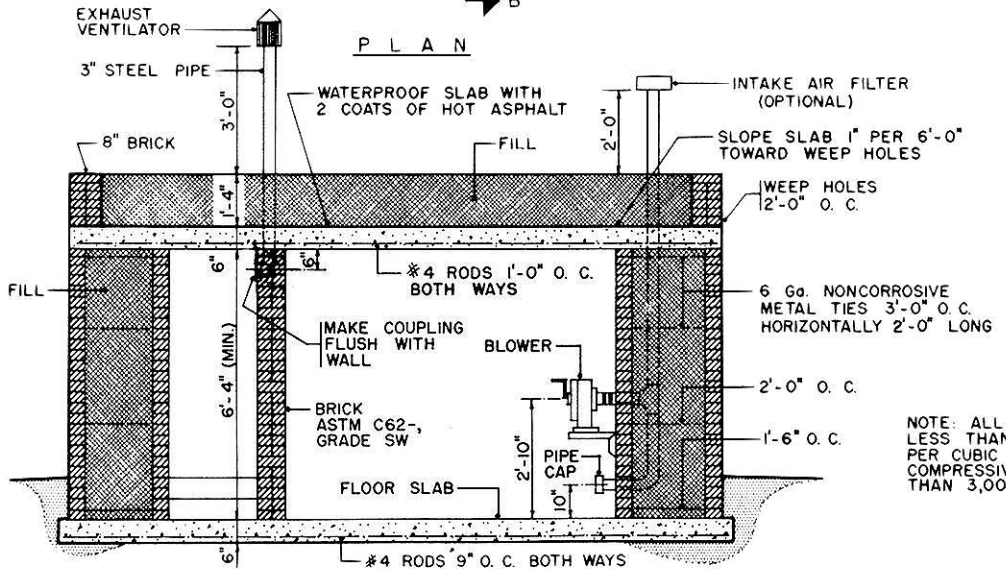
Figure 7



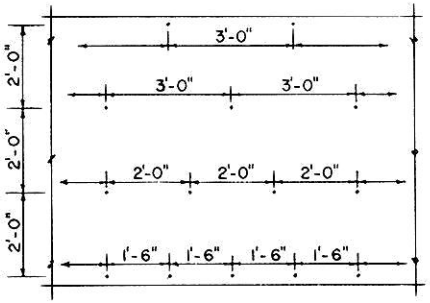
PLAN



SECTION B–B



SECTION A–A



TIE LOCATIONS

NOTE: ALL CONCRETE SHALL HAVE NOT LESS THAN 5 CUBIC FEET OF CEMENT PER CUBIC YARD OF CONCRETE AND A COMPRESSIVE STRENGTH OF NOT LESS THAN 3,000 PSI.

0 1 2 3 4
SCALE IN FEET

FALLOUT SHELTER
ABOVEGROUND NEW CONSTRUCTION
CLAY MASONRY DETAILS

STRUCTURAL CLAY PRODUCTS INSTITUTE
1520 18th ST. N. W. - WASHINGTON, D. C.

Dr. R. J. K. | Appr. R. J. K. | Date: Sept. 59

Figure 8

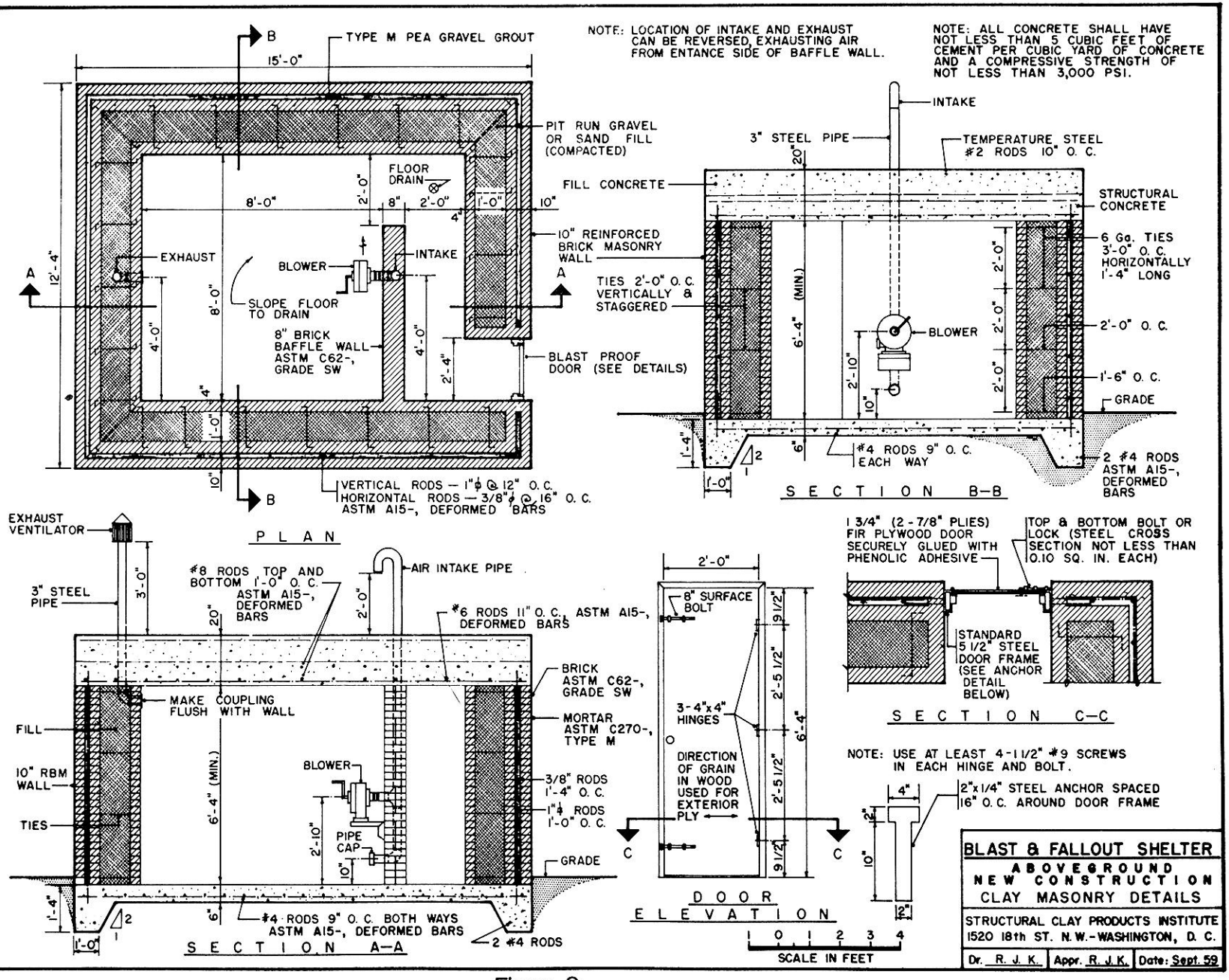

NOTE: LOCATION OF INTAKE AND EXHAUST CAN BE REVERSED, EXHAUSTING AIR FROM ENTANCE SIDE OF BAFFLE WALL.
NOTE: ALL CONCRETE SHALL HAVE NOT LESS THAN 5 CUBIC FEET OF CEMENT PER CUBIC YARD OF CONCRETE AND A COMPRESSIVE STRENGTH OF NOT LESS THAN 3,000 PSI.
TYPE M PEA GRAVEL GROUT
15'-0"
PIT RUN GRAVEL OR SAND FILL (COMPACTED)
FLOOR DRAIN
8'-0"
2'-0"
8"
2'-0"
1'-0"
10"
4"
10" REINFORCED BRICK MASONRY WALL
EXHAUST
BLOWER
INTAKE
SLOPE FLOOR TO DRAIN
8" BRICK BAFFLE WALL ASTM C62-, GRADE SW
BLAST PROOF DOOR (SEE DETAILS)
12'-4"
8'-0"
4'-0"
2'-4"
VERTICAL RODS — 1"ϕ @ 12" O. C.
HORIZONTAL RODS — 3/8"ϕ @ 16" O. C.
ASTM A15-, DEFORMED BARS
P L A N
INTAKE
3" STEEL PIPE
TEMPERATURE STEEL #2 RODS 10" O. C.
20"
FILL CONCRETE
STRUCTURAL CONCRETE
TIES 2'-0" O. C. VERTICALLY & STAGGERED
6 Ga. TIES 3'-0" O. C. HORIZONTALLY 1'-4" LONG
6'-4" (MIN.)
BLOWER
2'-10"
10"
2'-0" O. C.
1'-6" O. C.
GRADE
1'-4"
6"
#4 RODS 9" O. C. EACH WAY
2 #4 RODS ASTM A15-, DEFORMED BARS
1'-0"
S E C T I O N B—B
EXHAUST VENTILATOR
3" STEEL PIPE
3'-0"
#8 RODS TOP AND BOTTOM 1'-0" O. C. ASTM A15-, DEFORMED BARS
AIR INTAKE PIPE
2'-0"
#6 RODS 11" O. C. ASTM A15-, DEFORMED BARS
BRICK ASTM C62-, GRADE SW
MAKE COUPLING FLUSH WITH WALL
MORTAR ASTM C270-, TYPE M
FILL
10" RBM WALL
TIES
BLOWER
3/8" RODS 1'-4" O. C.
1"ϕ RODS 1'-0" O. C.
PIPE CAP
GRADE
#4 RODS 9" O. C. BOTH WAYS ASTM A15-, DEFORMED BARS
2 #4 RODS
S E C T I O N A—A
2'-0"
8" SURFACE BOLT
9 1/2"
2'-5 1/2"
3-4"x4" HINGES
6'-4"
DIRECTION OF GRAIN IN WOOD USED FOR EXTERIOR PLY
C
D O O R E L E V A T I O N
1 3/4" (2-7/8" PLIES) FIR PLYWOOD DOOR SECURELY GLUED WITH PHENOLIC ADHESIVE
TOP & BOTTOM BOLT OR LOCK (STEEL CROSS SECTION NOT LESS THAN 0.10 SQ. IN. EACH)
STANDARD 5 1/2" STEEL DOOR FRAME (SEE ANCHOR DETAIL BELOW)
S E C T I O N C—C
NOTE: USE AT LEAST 4-1 1/2" #9 SCREWS IN EACH HINGE AND BOLT.
2"x1/4" STEEL ANCHOR SPACED 16" O. C. AROUND DOOR FRAME
4"
2"
10"
2"
SCALE IN FEET
0 1 2 3 4
BLAST & FALLOUT SHELTER
ABOVEGROUND
NEW CONSTRUCTION
CLAY MASONRY DETAILS
STRUCTURAL CLAY PRODUCTS INSTITUTE
1520 18th ST. N.W.-WASHINGTON, D. C.
Dr. R. J. K.
Appr. R. J. K.
Date: Sept. 59

Figure 9

TABLE I.—Radiation Protection Factors

(For Small Aboveground Shelters)

Wall Mass Thickness, psf	Roof Mass Thickness, psf					
	100	150	200	250	300	400
100	12	15	15	15	15	15
150	25	40	45	50	50	50
200	40	85	115	140	145	150
250	50	130	230	335	385	415
300	55	160	345	670	910	1110
400	55	165	500	1670	5000	Greater than 5000

TABLE II.—Equivalent Mass Thicknesses (lb./sq. ft.)

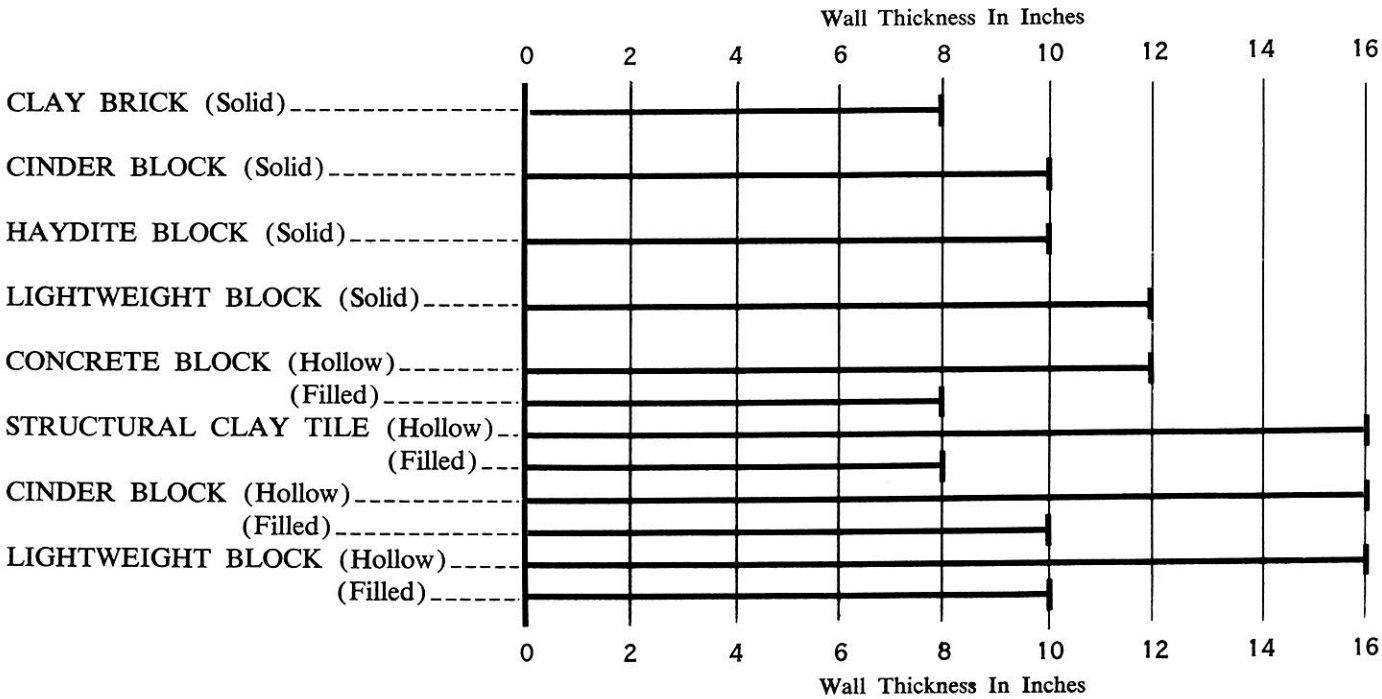


TABLE III.—Relation of Overpressure to Distances From Ground Zero*

(For a Typical Surface Blast)

Overpressure (psi)	Distance From Ground Zero	
	20 kilotons (atomic)	20 megatons (hydrogen)
40	1,500 ft. or 0.38 mi.	15,000 ft. or 2.8 mi.
20	1,900 ft. or 0.36 mi.	19,000 ft. or 3.6 mi.
10	2,700 ft. or 0.51 mi.	27,000 ft. or 5.1 mi.
5	4,000 ft. or 0.76 mi.	40,000 ft. or 7.6 mi.
2	8,000 ft. or 1.52 mi.	80,000 ft. or 15.2 mi.

* "The Effects of Nuclear Weapons"—U. S. Dept. of Defense, 1957
Fig. 3.94a, page 109.

TABLE IV.—Description of Shelter Protection Categories*

Protection factor	Shelter examples
1,000 or greater.	OCDM underground shelters. Subbasements of multistory buildings. Underground installations (mines, tunnels, etc.)
250 to 1,000.	OCDM basement fallout shelters (heavy masonry residences). Basements (without exposed walls) of multistory buildings.
50 to 250.	OCDM basement fallout shelters (frame and brick veneer residences). Central areas of basements (with partially exposed walls) of multistory buildings. Central areas of upper floors (excluding top floor) of large multistory buildings with heavy exterior walls and floors.
10 to 50.	Basements (without exposed walls) of small 1- or 2-story buildings. Central areas of upper floors (excluding top floor) of large multistory buildings with light exterior walls and floors.
2 to 10.	Basements (partially exposed) of small 1- or 2-story buildings. Central areas on ground floors in 1- or 2-story buildings with heavy masonry walls.
Less than 2.	Aboveground areas of low buildings, in general, including residences, stores, light industrial buildings.

* Based on current OCDM criteria.

TABLE V.—Tools Required for Building Basement Shelter, Existing Construction. (See fig. 5.)

ITEM	CHECK
Mixing pan for mortar	
Measuring pail for sand and cement	
Hoe for mixing mortar	
Hose or water can	
Mason's trowel (8″ or 10″)	
Mortar board	
Mason's level	
Mason's hammer	
Folding rule (6 ft.)	
Stringline and line blocks	
Chalkline, pencil	
Crosscut saw	
Claw hammer	
Carpenter's square	
Wrench (crescent)	
Drill, masonry bit, 5/8″, 5″ long wood bit, 5/8″, 4″ long	

TABLE VI.—Materials Required for Building Basement Shelter, Existing Construction. (See fig. 5.)

ITEM	AMOUNT
2-2/3″ x 4″ x 8″ brick	2250
8″ x 8″ x 12″ structural clay tile	205
2″ x 6″ structural grade lumber	35 lineal ft.
2″ x 4″ structural grade lumber	87 lineal ft.
1″ x 8″ (or 1″ x 12″) wood sheathing	88 board ft.
1/2″ x 6″ steel bolts	30
16 d nails, 8 d nails	1 lb. each
sand	60 cu. ft.
cement	2 cu. ft.
lime (or lime putty)	2 cu. ft.